

SECTION 05 50 00
METAL FABRICATIONS

PART 1 –GENERAL

1.01 SECTION INCLUDES

- A. Gratings.
- B. Metal Walkways.
- C. Trench Drains.
- D. Ladders.
- E. Concrete Stair Nosing.
- F. Steel Clips, Angles, Tubes, Pipes and Shapes.
- G. Anchors and Bolts.
- H. Galvanizing of Steel and Ferrous Metal Items.

1.02 RELATED SECTIONS

- A. Refer to the work under Division 32, Exterior Improvements and Division 33, Utilities, for curb and gutter inlets, catch-basin gratings, manhole covers, and other metalwork associated with, or embedded in, concrete utility structures.
- B. Stair nosing for precast concrete steps are specified in Section 03 40 00, Precast Concrete.

1.03 MEASUREMENT AND PAYMENT

- A. General
 - 1. Measurement and payment for metal fabrications and miscellaneous metal items will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for metal fabrications and miscellaneous metal items indicated in the Bid Schedule of the Bid Form.
 - 2. When metal fabrications or miscellaneous metal items are included as architectural features or components of the structure, they will not be measured separately for payment, but will be included in the lump-sum measurement for Architectural Work.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for metal fabrications and miscellaneous metal items, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00, Price and Payment Procedures, Article 1.03.

C. Unit Price: If the Bid Schedule indicates a unit price for metal fabrications and miscellaneous metal items, the unit-price method of measurement and payment will be as follows:

1. Measurement: Metal fabrications and miscellaneous metal items will be measured for payment by the lump sum, by the pound, by the linear or square foot, or per each metal fabrication or miscellaneous metal item, acceptably fabricated and installed, as indicated in the Bid Schedule of the Bid Form. When measured by the pound, weights will be calculated in accordance with AISC Code of Standard Practice for Steel Buildings and Bridges as specified in Section 05 12 00, Structural Steel Framing.
2. Payment:
 - a. Metal fabrications and miscellaneous metal items will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement methods specified in Article 1.03.C.1.
 - b. Metal fabrications and miscellaneous metal items for architectural features or components of the structure will be paid for as part of the indicated Contract lump-sum price for Architectural Work.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

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| 1. | ASTM A27 | Specification for Steel Castings, Carbon, for General Application |
| 2. | ASTM A36 | Specification for Carbon Structural Steel |
| 3. | ASTM A47 | Specification for Ferritic Malleable Iron Castings |
| 4. | ASTM A48 | Specification for Gray Iron Castings |
| 5. | ASTM A53 | Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| 6. | ASTM A108 | Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality |
| 7. | ASTM A123 | Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| 8. | ASTM A143 | Recommended Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement |
| 9. | ASTM A153 | Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware |

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| 10. ASTM A307 | Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile |
| 11. ASTM A384 | Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies |
| 12. ASTM A385 | Practice for Providing High-Quality Zinc Coatings (Hot-Dip) |
| 13. ASTM A449 | Specification for Quenched and Tempered Steel Bolts and Studs |
| 14. ASTM A500 | Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| 15. ASTM A501 | Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing |
| 16. ASTM A536 | Specifications for Ductile Iron Castings |
| 17. ASTM A563 | Specification for Carbon and Alloy Steel Nuts |
| 18. ASTM A668 | Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use |
| 19. ASTM A780 | Practice for Repair of Damaged Hot-Dip Galvanized Coatings |
| 20. ASTM D6386 | Practices for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Products and Hardware Surfaces for Painting |
| 21. ASTM F436 | Specification for Hardened Steel Washers |
- B. National Association of Architectural Metal Manufacturers (NAAMM):
- 1. Metal Bar Grating Manual
- C. Steel Structures Painting Council (SSPC):
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| 1. SSPC-SP 1 | Solvent Cleaning |
| 2. SSPC-SP 3 | Power Tool Cleaning |
| 3. SSPC-PA 1 | Shop, Field & Maintenance Painting |
| 4. SSPC-Paint 20 | Zinc-Rich Primers (Type I – Inorganic & Type II – Organic) |
| 5. SSPC-Paint 22 | Epoxy-Polyamide Paints (Primers, Intermediate & Topcoats) |

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit fully detailed Shop Drawings of metal fabrications and miscellaneous metalwork, showing sizes, details of fabrication and construction, methods of assembly, locations of hardware, anchors, and accessories, and installation details.
 - 1. Detailing Requirements: Detail steel components as specified in Section 05 12 00, Structural Steel Framing, and items to be galvanized in accordance with applicable requirements of ASTM A384 and ASTM A385. Detail and fabricate work with suitable drain and vent holes to provide positive drainage and to prevent trapping of moisture and stagnant air.
- C. Product Data: Submit manufacturers' product data of all manufactured items and products.

PART 2 –PRODUCTS**2.01 MATERIALS**

- A. General: Manufactured steel clips and angles will be accepted where such will meet the requirements of the Contract Drawings and are shown on approved Shop Drawings.
- B. Steel Materials:
 - 1. Shapes: Standard structural sections, shapes, plates, and bars, as indicated, conforming with ASTM A36. Bars conforming with ASTM A108 will be accepted.
 - 2. Tubing: Steel tubing, conforming with ASTM A500 or ASTM A501, of size and shape indicated.
 - 3. Pipe: Steel pipe or round tubing, conforming to ASTM A53, Type E or S, Grade A, of diameters and sizes indicated. Pipe for sleeves and exterior locations shall be galvanized pipe as specified in ASTM A53.
- C. Welding Rods/Electrodes: Refer to Section 05 05 22, Metal Welding, for requirements.
- D. Castings: ASTM A27, A47, A48, or A536, as applicable to the work.
- E. Forgings: ASTM A668, of Class indicated or required.
- F. Anchors and Bolts: ASTM A307, A449, A563, and F436, as applicable. Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153.

- G. Fasteners and Accessories: Furnish anchors and fasteners, washers, straps, and accessories as required for a complete and finished installation. Fasteners shall be stainless steel or galvanized steel as appropriate and approved for the location.
- H. Concrete and Masonry Anchors: Where anchors are not cast into the concrete or masonry construction, provide hot-dip galvanized expansion type anchors with matching hot-dip galvanized steel bolts or studs with nuts, of sizes as indicated or required. Provide washers under all bolt heads and nuts.
- I. Gratings:
1. Bar-Type Gratings:
 - a. Provide flat-bar type steel gratings of all-welded construction, consisting of bearing bars and secondary bars in rectangular configuration, with flat/plane level traffic surface, hot-dip galvanized after fabrication. Provide gratings with matching hot-dip galvanized steel frames for anchoring in concrete. Comply with applicable requirements of NAAMM "Metal Bar Grating Manual."
 - b. Notch or frame openings in gratings for penetrations as indicated. Lay out units to allow grating removal without disturbing items penetrating the grating. Provide banding for openings in grating separated by more than four bearing bars, of same material and size as bearing bars.
 - c. Cut, drill, and fit gratings as required for installation. Notching of bearing bars to provide supports for maintaining elevations will not be permitted.
 2. Perforated Sheet Gratings:
 - a. Provide perforated sheet gratings fabricated from button-embossed structural steel sheet of minimum 12 gage thickness, with punched circular holes at apex of buttons for nonslip effect, and punched circular holes between buttons for drainage. Buttons shall be spaced 5/8 inch on centers. Drainage holes shall be spaced 1-1/4 inches on centers, eliminating the buttons at these locations. Hole size for button holes shall be 1/8-inch diameter, plus or minus 1/32 inch. Hole size for drainage holes shall be 1/4-inch diameter, plus or minus 1/16 inch.
 - b. Supporting edges shall be channel- or U-shaped, formed edges capable of supporting a uniform live load of 300 pounds per square foot and a concentrated load of 3,000 pounds. Provide additional reinforcing as necessary to support the specified loads.
 - c. Provide gratings with matching steel frames for anchoring in concrete. Provide frames with appropriate concrete anchors.
 - d. Gratings and frames shall be hot-dip galvanized after fabrication in accordance with ASTM A123.
- J. Metal Walkways:
1. Provide metal walkways where indicated, fabricated from checkered or diamond-pattern steel plate or from button-embossed structural steel sheet as specified above for perforated sheet gratings.

2. Walkway panels shall be of sizes and plate or sheet thickness indicated, cut or formed to shape and configuration indicated. Walkway panels shall be removable where they serve as covers for wireways and trenches. Provide removable panels/covers with matching steel frames for anchoring in concrete. Provide hinges, chains, and related opening hardware as indicated for wireway covers. All hardware items shall be 300 series stainless steel or galvanized after fabrication.
3. Walkway panels shall be capable of supporting a uniform live load of 150 pounds per square foot and a concentrated load of 1,500 pounds.
4. Walkway panels and frames, including supporting and reinforcing components and accessories, shall be hot-dip galvanized after fabrication in accordance with ASTM A123.
5. When checkered or diamond-pattern steel plate is provided for walkway panels, coat panels with nonslip encapsulated aluminum oxide material bonded or fused to the steel surface. Submit product data and sample for approval.

K. Trench Drains:

1. Provide standard manufactured trench frames with grated or solid covers, as indicated, of sizes and configurations indicated. Trench drains/frames and covers shall be manufactured of gray iron conforming to ASTM A48 or ductile iron conforming to ASTM A536 or a combination of both. Provide heavy-duty type.
2. Provide covers with machined bearing surfaces to prevent rocking and rattling.
3. Where pedestrian traffic will travel over trench drains, provide covers with nonslip surface.
4. That portion of trench drains/frames to be in contact with concrete, earth or fill, shall be coated with bituminous emulsion.

L. Ladders:

1. Provide standard-manufactured or custom-fabricated steel ladders as required to meet the conditions indicated. Steel ladders shall be hot-dip galvanized after fabrication. Ladders may be anodized aluminum where not required to serve as a fire exit.
2. Ship's ladders shall be provided with railings and handrails. Vertical ladders exceeding 10 feet in height shall be provided with safety cages.

M. Concrete Stair Nosings: Abrasive cast aluminum in natural metal finish. Provide stair nosings of sizes and profiles indicated with nonslip finish and clean and well-defined cross-hatching and fluting a minimum of 1/16-inch deep. Provide deep lip stair nosings with appropriate integral concrete anchors; holes and countersinks for screw-type anchors are not acceptable. Minimum width of tread surface: 3 inches. Minimum thickness of tread or horizontal portion of nosing: 5/16 inch. Stair nosings

for cast-in-place concrete stairs shall have full radius return. Stair nosings for concrete-filled metal pan stairs shall have surface radius. Stair nosings at each tread shall be of a single piece; with no joints.

1. Reflective stripe at stairs:

- a. Furnish and install 2 inch wide 90 mil thick preformed thermoplastic reflective glass bead tape full width of stair nosing.
- b. Color: Yellow. Tape shall be heat adhered to the surface of the cast metal stair tread nosing

2. Stair nosings for precast concrete steps are specified in Section 03 40 00, Precast Concrete.

- N. Grout: Provide high-strength, non-shrink grout for base plates and bearing plates in accordance with the requirements of Section 03 61 11, Non-Shrink Grout, and Section 05 12 00, Structural Steel Framing, as applicable.
- O. Paint: Corrosion-inhibitive protective metal primer as herein specified under "Cleaning and Painting".

2.02 FABRICATION

- A. Metalwork shall be fabricated by firms or shops experienced and skilled in the custom fabrication and construction of metal fabrications and miscellaneous metalwork. There shall be no exposed screws, bolts, and fasteners in the finished work, except as indicated or required.
- B. Welded connections shall be made in accordance with requirements of Section 05 05 22, Metal Welding. Welds where exposed to view shall be ground and dressed smooth, so that the shape and profile of the item welded is maintained.
- C. Metal fabrications shall be prefabricated and preassembled in the factory or shop as far as practicable.
- D. Form and fabricate the work to meet installation conditions. Include anchors, fasteners, and accessories to secure the work in place, as indicated.
- E. The Contractor may furnish standard manufactured products for components when applicable, providing such products meet space limitations and installation conditions and are approved by the Engineer.

2.03 GALVANIZING

- A. Steel and ferrous metal items on the exterior of buildings, items exposed to the weather and moisture, gratings, and items specifically indicated, shall be galvanized after fabrication by the hot-dip process in accordance with ASTM A123. Weight of the zinc coating shall conform to the requirements specified under "Weight of Coating" in ASTM A123. Provide high-quality galvanizing in conformance with ASTM A385.

1. Seal-weld Overlapping Surfaces: Remove all weld flux. Plug vents provided in seal-welded overlapping surfaces to prevent entry of pickling acids. Remove such plugs before galvanizing.
- B. Safeguarding against steel embrittlement shall conform to the applicable requirements of ASTM A143.
- C. Safeguarding against warpage and distortion of steel members shall conform to the applicable requirements of ASTM A384.
- D. Shop galvanized metalwork necessitating field welding which in any manner removes original galvanizing shall be restored by field galvanizing repair in accordance with ASTM A780.
- E. Bolts and screws for attachment of galvanized items shall be galvanized in accordance with ASTM A153.

2.04 CLEANING AND PAINTING

- A. Nongalvanized Metalwork:
 1. After fabrication and immediately before shop painting, ferrous metalwork shall be power-tool cleaned in accordance with SSPC-SP 3 to remove mill scale, rust, grease, oil, and any other foreign matter. Welds shall be thoroughly wire brushed.
 2. After power-tool cleaning and just before shop painting, ferrous metalwork shall be washed with solvent to remove dust and residue in accordance with SSPC-SP 1.
 3. After cleaning and solvent washing, ferrous metalwork shall be shop painted with one coat of corrosion-inhibitive metal primer in accordance with SSPC-PA 1. Materials and application shall conform to SSPC-Paint 20 or SSPC-Paint 22.
- B. Galvanized Metalwork:
 1. Galvanized metal surfaces indicated to be painted shall be prepared for painting in accordance with ASTM D6386.

PART 3 –EXECUTION

3.01 INSTALLATION

- A. Install metal fabrications and miscellaneous metalwork as indicated and in accordance with the approved Shop Drawings, using workers skilled and experienced in the installation of the type of work involved.
- B. Install metal fabrications and miscellaneous metalwork with all installation accessories furnished by the fabricator as required for complete and finished installations.

- C. Installation of metalwork shall be in accordance with approved Shop Drawings, true and horizontal, perpendicular, or at the required angle, as the case may be, level and square, with angles and edges parallel with related lines of the building or structure.
- D. Field welding, where indicated, shall conform to requirements of Section 05 05 22, Metal Welding.
- E. Where bases and bearing plates require grouting, conform to requirements of Section 03 61 11, Non-Shrink Grout, and Section 05 12 00, Structural Steel Framing, as applicable.

3.02 GALVANIZING REPAIR

- A. Galvanized surfaces which have become damaged from welding, handling, or installation shall be repaired immediately after installation with galvanizing repair material in accordance with ASTM A780.

3.03 FIELD PAINTING

- A. After installation, exposed painted surfaces, field welds, and other abraded or damaged primed surfaces shall be prepared as required and touched up with an additional coat of the same primers for ferrous and galvanized surfaces as herein-before specified for shop painting. Spray-paint all touch-up work.
- B. Finish field painting, where required, is specified in Section 09 91 00, Painting.

END OF SECTION 05 50 00